TMD DISCUSSION PAPER NO. 8

THE IMPACT OF THE MEXICAN CRISIS ON TRADE, AGRICULTURE, AND MIGRATION

Sherman Robinson
International Food Policy Research Institute
and University of California, Berkeley

Mary Burfisher
Economic Research Service, USDA

Karen Thierfelder
U.S. Naval Academy

Trade and Macroeconomics Division

International Food Policy Research Institute
1200 Seventeenth Street, N.W.
Washington, D.C. 20036-3006 U.S.A.

September 1995

TMD Discussion Papers contain preliminary material and research results, and are circulated prior to a full peer review in order to stimulate discussion and critical comment. It is expected that most Discussion Papers will eventually be published in some other form, and that their content may also be revised.

Table of Contents

Figures

Abstract

This paper uses a two-country, computable general equilibrium (CGE), trade model to analyze the impact on Mexico and the U.S. of the precipitous peso depreciation in late 1994 and early 1995, and of the policy response to the crisis. The model includes explicit treatment of agricultural policies in the two countries, and of labor-market linkages, including rural-urban migration within Mexico and Mexico-U.S. migration. We explore "hard," "medium," and "soft" landing scenarios, which differ in the extent of assumed unemployment and fall in capacity utilization, and in the nature of the structural adjustment program in Mexico. For each scenario, we consider a range of balance-of-trade adjustments, and resulting changes in the equilibrium real exchange rate. The results indicate that both countries benefit from Mexico achieving a soft landing. It is important to achieve a new equilibrium exchange rate quickly, and overshooting is costly for both countries. The hard landing leads to major disruption of the Mexican economy and greatly increased migration to the U.S., while a soft landing yields very little additional migration. The structural adjustment program is good for Mexican agriculture, shifting resources into high productivity tradables such as fruits and vegetables. A protectionist U.S. response to the increase in Mexican exports hinders the structural adjustment process and leads to increased Mexico-U.S. migration.

Revised version of a paper presented at the Plenary Conference of the North American Agricultural Policy Research Consortium, Stanford University, Stanford, CA, May 5–6, 1995. Conference title: "Towards a Continental Agricultural Policy."

1. Introduction

For the past few years, Mexico has benefited from large inflows of short-term foreign capital. It has been widely recognized that these large annual flows were unsustainable in the longer run. Furthermore, the resulting appreciation of the peso was actually hindering the desirable changes in trade structure that have been underway since the mid-1980's and should continue under NAFTA. The question was not whether there would be a real depreciation, but how smoothly and over what time period. In December 1994, Mexico was forced to float the exchange rate. There was a precipitous depreciation accompanied by short-term capital flight. The question now is how will the economy adjust? Will Mexico have a "hard landing" similar to their experience in the early 1980s, with major unemployment, declines in capacity utilization, and increased migration to the U.S.? Or, with appropriate policies, can they achieve a "soft landing," making the needed adjustments without serious disruption of the economy or increased migration?

NAFTA, which started in January 1994, should greatly facilitate the needed adjustments in trade by gradually lowering barriers to Mexican exports to the U.S. and Canada. In addition, Mexico has adopted a stabilization package, including tightened government spending and monetary policies, salary limitations, and some expansion of privatization. The Mexican program is intended to reassert macro control, limit the inflationary impact of the depreciation, restore investor confidence, and so support the structural changes that are underway. Indeed, the structural adjustment program now being implemented can be seen as accelerating trends toward North American integration that were underway under the liberalization program that started in the mid-1980s, and that were further facilitated by the creation of NAFTA.

Strong trade, capital market, and migration links between the U.S. and Mexico give the U.S. a special interest in Mexico's ability to achieve a soft landing. These links also offer a conduit through which U.S. policies with respect to the peso crisis can significantly influence Mexico's ability to avoid a hard landing. For example, U.S. agricultural policies will have an important role in shaping Mexican adjustment through their effects on Mexican farm export growth, on rural labor demand, and, consequently, on migration. About one-quarter of Mexico's labor force is employed in agriculture, and these rural workers are the source of labor migration to urban Mexico and the U.S. Under a soft landing, the depreciation and concomitant structural adjustment should stimulate agricultural exports, resource shifts within agriculture, and rural labor demand, and so help reduce migration pressure. A hard landing, with declines in capacity utilization and employment, and perhaps increased barriers to exports into the U.S., will generate costly and disruptive labor migration flows. It is important that the two countries coordinate their policy responses, taking into account the high degree of integration of their product and factor markets.

In this paper, we analyze the role of Mexican and U.S. policies in supporting Mexico to achieve a soft landing. We utilize a computable general equilibrium trade model of the U.S. and Mexico to compare the effects of the Mexican crisis under alternative policy scenarios. We consider various hard and soft landing scenarios, and consider the potential role of U.S. policy

reactions, especially in agriculture. In the next section, we describe current agricultural and trade policies, particularly the recent developments under NAFTA and PROCAMPO. In section three, we describe the model. In sections four and five, we describe the scenarios and present model results. Our conclusions are in section six.

2. Recent Developments in Agricultural Policies

There are two recent major developments in agricultural policy in the U.S. and Mexico. One is the North American Free Trade Agreement (NAFTA), implemented in January 1994. The second is PROCAMPO, Mexico's new farm support program announced in October 1993.

NAFTA

The NAFTA agreement in agriculture provides for immediate elimination of tariffs and other restrictions for many commodities — most of them already duty free or subject to low tariffs.[1] For certain other products, a 5-to-10 year phase-out period is permitted. A few commodities are subject to a 15-year phase out of trade barriers. In the U.S., these include selected fruits and vegetables. In Mexico, they are dry beans, corn, dry milk, orange juice, and sugar. A ten-year phase-out of trade barriers is specified for Mexico's imports of rice, wheat, soybeans, poultry, and selected horticultural crops, and for U.S. imports of rice, wheat, dairy products, and some horticulture.

All quotas are converted immediately to tariff rate quotas (TRQs). There are two alternative treatments of the TRQ's over time. First, for those commodities protected by import quotas prior to the NAFTA, a duty free import quantity is permitted immediately, to be increased annually based on a 3 percent compound annual growth rate in quantity. Within-quota imports are subject to preferential tariffs established under NAFTA, to be phased out over 10–15 years. Over-quota amounts are subject to tariffs set to match current levels of non-tariff protection. Commodities with this TRQ treatment include U.S. imports of peanuts and sugar, and Mexican imports of dry beans, corn, and dry milk.

Second, for some sensitive commodities protected by tariffs prior to NAFTA, TRQs are introduced as a safety provision to prevent import surges. Within-quota quantities are to be increased at a 3 percent compound rate over 10 years. For imports above that quantity, tariffs could be imposed, to be eliminated (not phased out) at the end of 10 years. The tariff rate is not to exceed the lower of the most-favored nation (MFN) rate as of July 1991 or the prevailing MFN rate. For the U.S., this "snap-back" provision applies to selected horticultural imports. For Mexico, this treatment covers imports of swine, pork, apples, potatoes and coffee products.

An important determinant of the landing conditions for Mexico will be the willingness of

[1]Provisions of the NAFTA agreement are summarized in Congressional Budget Office (1993).

the U.S. to accept higher levels of horticultural imports from Mexico as the peso depreciates, despite the right it has preserved under NAFTA for "snap-back" protection. Effects of a snap-back would be significant for the Mexican economy because horticulture is the main potential source for expanded Mexican farm exports, and because labor migration flows to the U.S. are highly sensitive to employment conditions in rural Mexico.

PROCAMPO

In the past, Mexico supported its agriculture through an extensive and complex system of subsidized inputs, guaranteed prices, subsidized retail food sales, and high import barriers. Mexico's accession to NAFTA meant that import barriers could no longer be used as its main instrument of farm support. Yet, because of the large proportion of Mexican labor employed in farming, the immediate exposure of agriculture to market forces was undesirable. In response, Mexico adopted PROCAMPO, a program that transforms farm support from a program based mainly on import protection to a program of fixed, direct payments to farm households. The intent of PROCAMPO is to provide temporary support to agriculture, helping to maintain farm income while giving NAFTA time to stimulate agricultural exports and nonagricultural labor demand.

PROCAMPO provides direct income support payments based on historical acreage planted to eligible crops, including corn, beans, wheat, cotton, safflower, soybeans, sorghum, rice, and barley. It is designed to be a 15-year transitional support program, providing fixed real payments for ten years, with a gradual phasing out of payments in years 11 through 15. By providing direct payments, the program decouples support from output decisions, permitting the sectoral composition of Mexican agriculture to respond to world price signals throughout the duration of PROCAMPO. In contrast to a system of import protection, the PROCAMPO farm support program requires large fiscal expenditures.

Fiscal austerity under the structural adjustment program may affect Mexico's ability to maintain PROCAMPO payments. On the other hand, the depreciation will lead to increased domestic agricultural prices, import substitution, and export expansion, accelerating the agricultural adjustments already underway. Agriculture will benefit from these changes, which may obviate the original need for PROCAMPO. These issues are explored in the empirical analysis below.

3. The NAFTA-CGE Model

The U.S.-Mexico model links two single-country, 29-sector, computable general equilibrium (CGE) models through commodity trade and labor migration. The model focuses on sectoral resource allocation, production, and trade flows. The model emphasizes agriculture and includes an explicit modeling of agricultural programs (including trade policies) in both countries. The model solves for relative prices, wages, and the real exchange rates that equilibrate product markets, factor markets, and the balance of trade in the two countries. The

model is documented in detail elsewhere, and we describe here only our treatment of agricultural policies, labor migration, and macro closure.[2]

Agricultural Policies

Agricultural policies are modeled either as price wedges, which affect output decisions, or lump-sum income transfers. The wedges and transfers are either specified exogenously or determined endogenously, based on the institutional characteristics of the program being modeled. The Mexican agricultural policies that we model are PROCAMPO and the low-income tortilla subsidy, which operates as a kind of food stamp program. Both programs are modeled as transfer payments to households, which do not distort production decision. Costs of both programs enter into Mexican agricultural program expenditures.

For the U.S., we model the deficiency payment program and the Export Enhancement Program (EEP). Deficiency payments are based on fixed acreage and yield times the difference between a target price and the market price for each program crop. In the model, the payment rate is solved endogenously as the difference between the fixed target price and the solution market price. The EEP program is treated as an *ad valorem* export subsidy. The subsidy rate is applied as a mark-up on the world export price, which allows U.S. producers to lower the world price of their goods relative to other suppliers, while maintaining their received price. Total expenditures on deficiency payments and EEP expenditures are included in U.S. farm program expenditures.

In both countries, the tariff equivalents of import quotas are modeled endogenously. The initial tariff equivalent is calculated as the "price-gap" between the world price and the domestic price. The quota's *ad valorem* equivalent (and hence the value to license holders of the import premia) changes with the price gap. Premium income from each sector is retained domestically and distributed to the holders of import licenses. Tariffs are modeled with fixed *ad valorem* rates, and tariff revenues are paid by consumers to the government.

The model also incorporates indirect taxes, value-added taxes (in Mexico), social security taxes, income taxes, and enterprise taxes. These policies, together with distortions in base sectoral factor returns and differences in production technologies, create a second-best environment for policy experiments.

Labor Migration

The model specifies three migration flows: rural Mexico to rural U.S. labor markets, urban unskilled Mexico to urban unskilled U.S. labor markets, and internal migration within

[2]The model is documented in Burfisher, Robinson, and Thierfelder (1992). Our treatment of labor migration is described more fully in Burfisher, Robinson, and Thierfelder (1994). The data base is documented in Burfisher, Thierfelder, and Hanson (1992).

Mexico from rural to unskilled urban labor markets. Labor migration is assumed to adjust to maintain the existing wage differentials between the two countries.

In equilibrium, migration levels are determined which maintain a specified ratio of real wages, $wgdf_{mig}$, for each labor category in the two countries, measured in a common currency, and a specified ratio of real wages between the rural and unskilled urban markets in Mexico. The international migration equation is:

$$WF_{mig,mx} = wgdf_{mig} \cdot WF_{mig,us} \cdot \left(s\frac{EXR_{mx}}{EXR_{us}} + (1-s)\frac{EXR0_{mx}}{EXR0_{us}} \right)$$

where the index *mig* refers to the three migration flows, WF is the wage, EXR is the solution equilibrium exchange rate, and EXR0 is the base year exchange rate. Migrants' sensitivity to exchange rate changes is described by *s*, the share of earnings remitted.[3] In the internal migration equation for Mexico, rural and urban workers compare wages within Mexico, and there is no exchange rate effect. For rural workers in Mexico, the average wage in the migration decision includes a share of land rental income and a share of direct payments. The domestic labor supply in each skill category in each country is adjusted by the migrant labor flow.

There are several implications of this specification of migration. One is that Mexican-U.S. migration is assumed to be sensitive to changes in the exchange rate. Insofar as potential migrants plan to remit part of their earnings back home, peso depreciation makes migration more desirable since the dollars earned in the U.S. are worth more to their families in pesos back in Mexico. It is also the case that when *s* is nonzero, and exchange rate changes affect the migrant's decisions, real wages can grow at different rates measured in the domestic currency. As the remittance share rises, in situations where the exchange rate changes, it is likely that migration will be observed from a labor market where the real wage is rising to one where it is falling, measured in terms of domestic prices.

Another implication of the migration specification is that, since a share of direct payments is assumed to enter the rural wage, PROCAMPO payments are assumed to influence the migration decision. In fact, the likely effects of PROCAMPO on migration are not easily determined. Since the program payments are based on historical acreage, they will appear as lump-sum payments to households. They will raise farm household income, but may have no direct effect on the decision to migrate, if potential migrants look only at returns at the margin. PROCAMPO could even increase migration by providing an assured source of income that enables workers to undertake the fixed costs of a move to urban Mexico or the U.S. Alternatively, rural households might view the payments as a wage supplement, enabling them to stay in agriculture despite falling wages under some shock. In Burfisher, Robinson, and Thierfelder (1994), we explore the sensitivity of migration and agricultural output changes to alternative views on farmers' reactions to the income transfer. In this paper, we assume a that a fixed share

[3]Lozano (1993) suggests that 15-20 percent of migrant income is remitted. We assume a remittance rate of 20 percent. Sensitivity analysis indicates that the impact of changes in the exchange rate on migration is very sensitive to the assumed rate.

of direct payments affects the migration decision through its inclusion in the computation of the rural wage.

Finally, migration flows generated by the model refer to changes in migration from a base of zero. They should be seen as additional migration flows due to the policy change, adding to current flows.

Macro Closure

There are three key macro balances in each country model: the government deficit, aggregate investment (and savings), and the balance of trade. Government savings is the difference between revenue and spending, with aggregate real spending fixed exogenously but revenue depending on a variety of tax instruments. The government deficit is therefore determined endogenously. Aggregate investment is determined as a fixed share of GDP, and aggregate private savings is determined residually to achieve savings-investment balance.[4] The balance of trade for each country (and hence foreign savings) is set exogenously, valued in world prices.

Each country model solves for relative domestic prices and factor returns that clear the factor and product markets, and for an equilibrium real exchange rate given the exogenous aggregate balance of trade in each country. A domestic price index defines the numeraire in each country model, and the currency of the rest of the world defines the international numeraire. The model determines two equilibrium real exchange rates, one each for the U.S. and Mexico, which are measured with respect to the rest of the world. The cross rate (U.S. to Mexico) is implicitly determined by an arbitrage condition. For each country, the model incorporates a functional link between the balance of trade and the real exchange rate. Depreciation of the real exchange rate can be simulated by reducing the exogenous balance of trade (exports minus imports).

The model is neoclassical, focusing on changes in relative prices and changes in the structure of employment, production, and trade. All factors are intersectorally mobile, and can be moved around with no adjustment costs or "frictional" unemployment. The major macro balances are treated as essentially exogenous. The macroeconomics is neoclassical, not Keynesian: full employment, no adjustment costs, and government borrowing that accommodates fixed real expenditure and endogenous changes in tax revenues without inflationary repercussions. In this type of model, any macroeconomic adjustment costs arising from some shock must be specified exogenously. Changes in capacity utilization, aggregate employment, government expenditure, investment, and the balance of trade that are the building blocks of macro adjustment scenarios can be imposed on the model.

[4]Enterprise savings rates are assumed to adjust to achieve the necessary level of aggregate savings in each country.

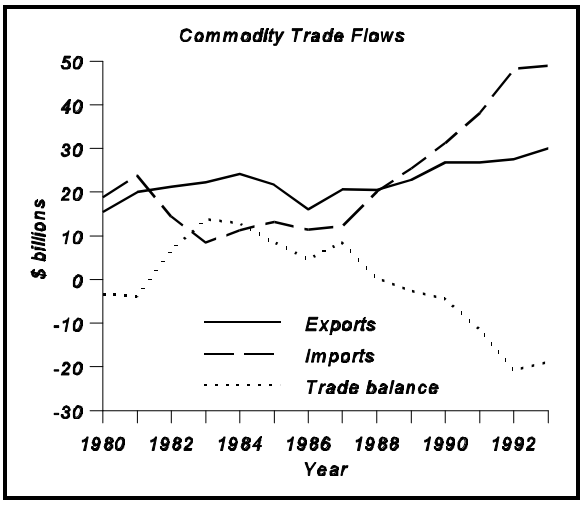

Figure 1: Mexican Commodity Trade Flows

4. Alternative Adjustment Scenarios

We analyze three adjustment scenarios. For each scenario, we do five experiments, increasing the balance of trade (exports minus imports) in $5 billion increments to a final amount of $25 billion.[5] Figure 1 provides data on merchandise trade for Mexico (in current dollars) and the trade balance since 1980. The adjustment during the crisis in the early 1980s led to a $15 billion swing in the trade balance. The decline in the merchandise trade balance after 1986 is dramatic, and the deficit of around $20 billion in 1992-1993 is a record low. Considering the historical experience, the specification in the experiments of a swing of $5–25 billion should certainly bracket the likely range of required adjustment in the trade balance.

In all three scenarios, we assume that NAFTA and PROCAMPO are largely in effect, so that model results reflect changes from an equilibrium in which the two programs are operational. All bilateral trade barriers are removed except on those Mexican commodities permitted a 15-year phase out. For Mexico, these are corn, beans, and milk products. For the U.S., we assume no horticultural import tariffs, despite some 15-year TRQ protection permitted under NAFTA. We treat TRQ rates for Mexico and the U.S. differently because initial within-

Table **1**: Adjustment Scenarios

Hard landing	For each $5 billion improvement in trade balance: capacity utilization and aggregate employment are reduced by 1.5%; government expenditure is reduced by 2.0%; and the investment rate is reduced by 1 percentage point.
Medium landing	For each $5 billion improvement in trade balance: capacity utilization and aggregate employment are reduced by 1.0%; government expenditure is reduced by 1.5%; and the investment rate is reduced by 1 percentage point.
Soft landing	For each $5 billion improvement in trade balance: no change in capacity utilization or aggregate employment; government expenditure is reduced by 1.0%; and the investment rate is reduced by 0.65 percentage points.

[5]Since the model is based on 1988 data and the changes in the balance of trade are in current dollars, we deflate the increments to put them in 1988 prices (dividing by 1.27).

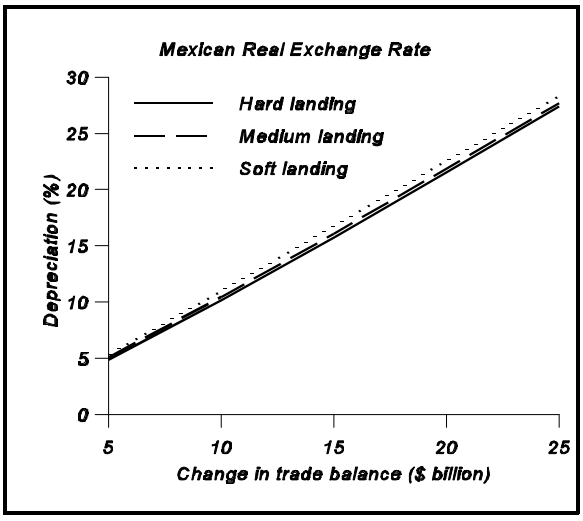

Figure 2: Mexican Exchange Rate Depreciation

quota amounts specified by the U.S. in the NAFTA agreement far exceed current import levels. In Mexico, on the other hand, initial within-quota amounts were generally already at or below average current import quantities (CBO, 1993).

The three scenarios are described in Table 1. The first two scenarios include declines in capacity utilization and aggregate employment, reflecting the view that macro adjustment will disrupt the economy and lead to a decline in GDP, even over the medium run. The third "soft landing" scenario assumes no lasting adjustment problems. In this view, the economy is able to undergo rapid and successful structural adjustment, and the scenario reflects a snapshot of the economy once full employment is restored.

All three scenarios involve a decrease in absorption (total domestic demand, which equals GDP plus imports minus exports), as the economy must adjust to higher exports and lower imports. We specify the macro adjustment to the absorption decline exogenously, spreading the decline among government expenditure, investment, and consumption. Aggregate investment is assumed to decline the most. There is a smaller percentage decline in government expenditure, and aggregate consumption declines somewhat less in percentage terms than total absorption.

5. Empirical Results

Macroeconomic Effects

In the three scenarios, the impact of changes in the balance of trade on the Mexican real exchange rate are very close. The results are shown in Figure 2. The relationship is virtually linear, with a $1 billion improvement in the trade balance requiring about a percentage point depreciation of the equilibrium real exchange rate. Based on "fundamentals" — import demand and export supply functions — the panic Mexican depreciation of more than 40 percent significantly overshoots the new equilibrium real exchange rate, assuming no change in inflation. The CGE model is not a macro model and cannot be used to determine a "sustainable" or "equilibrium" balance of trade. Given the underlying strengths of the Mexican economy, however, it is highly unlikely that Mexico will have to adjust to a sustained annual improvement in the balance of trade of $20–25 billion — $10–15 billion is far more likely, which implies a required depreciation of 10–15 percent.[6]

[6]See Sachs *et al.* for a macro perspective on the Mexican crisis.

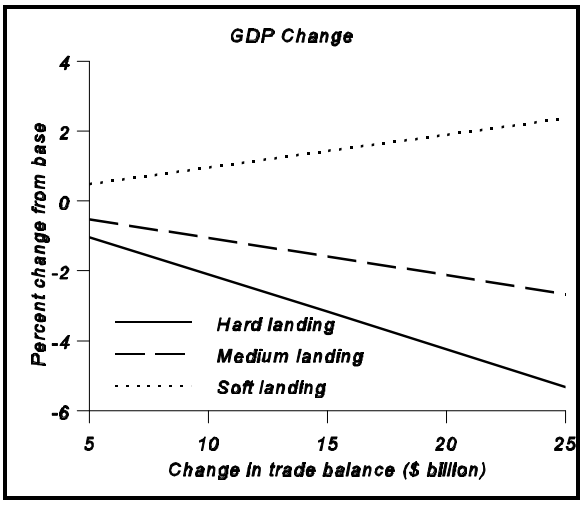

Figure 3: Mexican GDP Changes

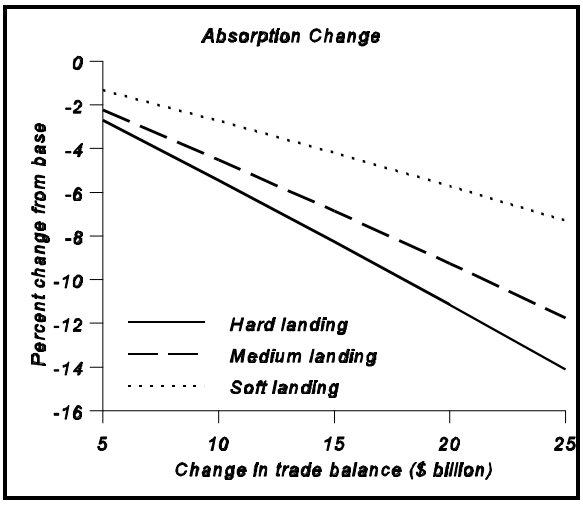

Figure 4: Mexican Absorption Changes

Figures 3 and 4 show the different effects of the three scenarios on GDP and aggregate absorption. The hard and medium landing scenarios involve significant declines in GDP, given the exogenously specified unemployment and decline in capacity utilization. The soft landing generates increases in GDP, which reflects the shift of resources into tradable sectors where productivity is higher. The structural adjustment process generated by the depreciation essentially speeds up trends initiated by the opening up of the Mexican economy in the mid-1980s and continued through the creation of NAFTA. In all scenarios, aggregate absorption declines. Even in the soft landing, the decline in absorption due to the improvement in the trade balance more than offsets the increase in GDP. While structural adjustment is beneficial, it must be undertaken in an environment of decreasing real incomes, which exacerbates the social and political stresses that are part of the process in the best of circumstances.

A large real depreciation has a major impact on U.S.-Mexican trade, significantly cutting U.S. exports to Mexico and increasing Mexican exports to the U.S. (Figure 5). In percent terms, real Mexican exports rise more than real imports fall. Intermediate and capital good imports into Mexico have low substitution elasticities with domestic goods (and hence low price elasticities of demand). In essence, Mexico has to increase exports in order to maintain imports of crucial goods. There is also a terms of trade loss, as Mexico faces downward sloping demand curves in the U.S. for its exports and upward sloping U.S. supply curves for its imports.[7]

The final equilibrium of the economy is certainly responsive to changes in the real exchange rate. The model assumes that producers view the price changes as long lasting. Any overshooting in the exchange rate will confuse the price signals, since producers will not know

[7]Since aggregate base exports are lower than base imports, percent changes for exports will be larger than for imports because the denominators are different, even with no change in the trade balance.

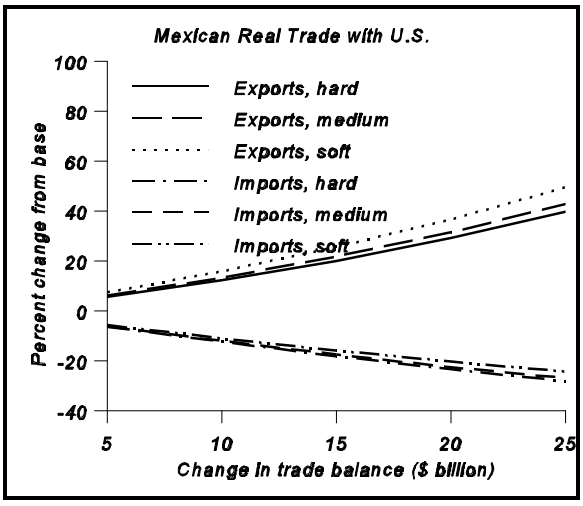

Figure 5: Mexican Real Trade With U.S.

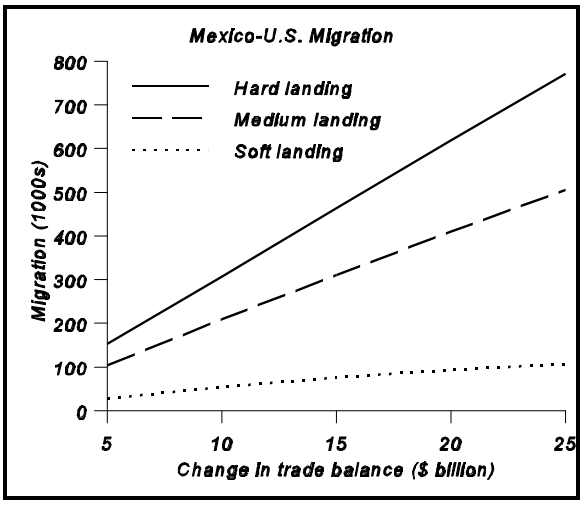

Figure 6: Mexico-U.S. Migration

how long lasting are the changes, and will be uncertain in their responses. It is important to give producers the correct price signals, since too rapid or too much structural adjustment is difficult and costly, on both sides of the border. The danger from overshooting is that too much depreciation will greatly, and unnecessarily, disrupt U.S.-Mexico trade. Any policies — such as the U.S.-led credit guarantee program — that facilitate the rapid establishment of the new long run equilibrium exchange rate greatly benefit both Mexico and the U.S.

Migration

Figure 6 shows the effects of the Mexican crisis on Mexican migration to the U.S. under the three scenarios. Three major forces determine the changes in migration flows. First, depreciation leads to structural adjustment in Mexico, generating increased exports, lower imports, and changes in production structure. These changes are productivity enhancing and labor demanding, and would normally reduce migration pressure.[8] Second, depreciation has a direct effect on migration, making wages denominated in dollars more attractive to potential migrants who want to remit income. Finally, declining GDP and absorption exert downward pressure on real wages and incomes in Mexico, encouraging migration.

The hard and medium landing scenarios generate major increases in migration, peaking at 772,000 in the worst hard landing experiment. Three forces are at work. First, changes in the exchange rate have a direct effect on migration. Second, the fall in GDP (in the hard and medium scenarios) and the change in the trade balance (in all three) cause absorption to fall, lowering Mexican incomes and encouraging migration. Finally, structural adjustment leads to increased exports and import substitution, which increases efficiency and labor demand,

[8]See Hinojosa and Robinson (1992) for a survey of studies of the impact of NAFTA on Mexican labor markets and migration.

discouraging migration. In the soft landing scenario, GDP increases and the structural adjustment effects largely offset the direct effects of depreciation and the fall in absorption, and migration increases only slightly.[9] The effects of structural adjustment on migration are important and depend critically on what happens within Mexican agriculture, since rural-urban migration within Mexico has a domino effect on Mexican-U.S. migration.

Adjustment and Mexican Agriculture

The agriculture sector is especially sensitive to the effects of the Mexican crisis. Table 2 provides data on the structure of Mexican crop production and their dependence on trade. Fruits and vegetables is a large sector and is very dependent on exports, mostly to the U.S. The other sectors are more import dependent, especially oilseeds (a heterogeneous sector, with both high exports and imports).

Table 2: Structure of Mexican Crops

	Composition (%):			Ratios: (%):	
	Output	Exports	Imports	Exports/ output	Imports/ supply
Cotton	0.8	0.0	2.0	0.0	26.4
Food grain	6.3	0.4	10.7	1.0	19.1
Food corn	16.6	0.0	24.1	0.0	16.8
Feed grain	19.2	0.1	16.0	0.0	10.4
Fruits/vegetables	20.1	67.3	0.9	46.8	1.1
Beans	4.0	0.0	4.5	0.0	13.4
Oilseeds	1.6	2.0	34.8	17.8	78.6
Other agriculture	31.5	30.1	6.9	13.4	3.4
Total/average	100.0	100.0	100.0	14.0	13.9

Note: The data refer to 1988 peso values. "Supply" is output plus imports minus exports.
Source: Burfisher, Thierfelder, and Hanson (1992)

Table 3 provides data on the allocation of labor and of irrigated and non-irrigated land in the crop sectors. Food corn is very important, using a lot of labor, over half the unirrigated land, and a quarter of the irrigated land. Corn and beans are the most labor intensive crops. Fruits and vegetables are also important, using a lot of irrigated land and with a relatively high ratio of irrigated to unirrigated land. In the model, we assume that the two types of land are relatively substitutable in producing grains, but not in producing fruits and vegetables. Thus, any expansion of fruit/vegetable production requires diverting irrigated land away from other crops.

[9]Sensitivity analysis indicates that this result is very sensitive to the remittance parameter, *s*. Lowering *s* generates a U-shaped migration response in the soft landing scenario, with migration turning negative as the structural adjustment effect dominates.

Table 3: Land and Labor Use in Mexican Agriculture

Sector	Labor (1000s)	Land (1,000 hectares): Irrigated	Unirrigated	Labor shares (%)	Land shares (%) Irrigated	Unirrigated
Cotton	43	100	47	1.0	2.6	0.4
Food grain	306	735	303	7.0	19.3	2.7
Food corn	1915	887	5619	43.7	23.3	50.7
Feed grain	679	629	1678	15.5	16.5	15.1
Fruits/vegetables	299	571	446	6.8	15.0	4.0
Beans	572	237	1710	13.1	6.2	15.4
Oilseeds	128	236	197	2.9	6.2	1.8
Other agriculture	438	406	1082	10.0	10.7	9.8
Total	4380	3801	11082	100.0	100.0	100.0

Note: The data refer to 1988.
Source: Burfisher, Thierfelder, and Hanson (1992).

Figure 7 shows the changes in crop production in the medium landing scenario. The other scenarios show similar changes. The depreciation generates dramatic increases in the production of tradable crops — oilseeds and fruits/vegetables. Oilseeds is a small sector, but has a very high import share, with much scope for import substitution. Fruits/vegetables is an export sector, and exports increase dramatically in all scenarios. In the medium landing scenario, as the trade balance is incrementally improved, fruits/vegetables exports rise 14–97 percent and output increases 5–34 percent. Production of both corn and beans declines slightly, as the other sectors bid resources away from them.

Figure 8 shows what happens to the returns to land in the medium landing scenario (the results are similar for the other two scenarios). The value of both types of land increases

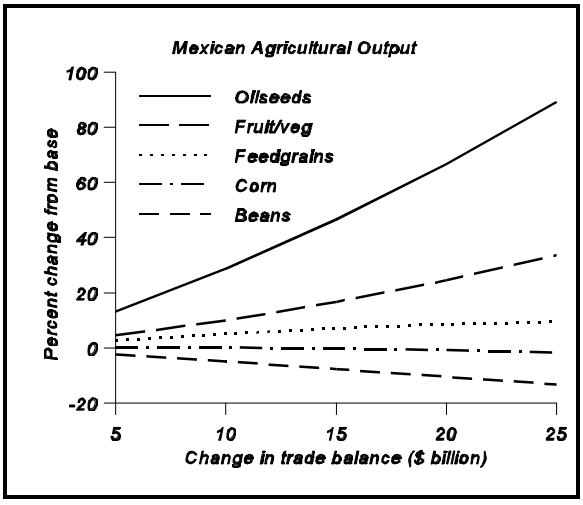

Figure 7: Mexican Agricultural Production, Medium Landing

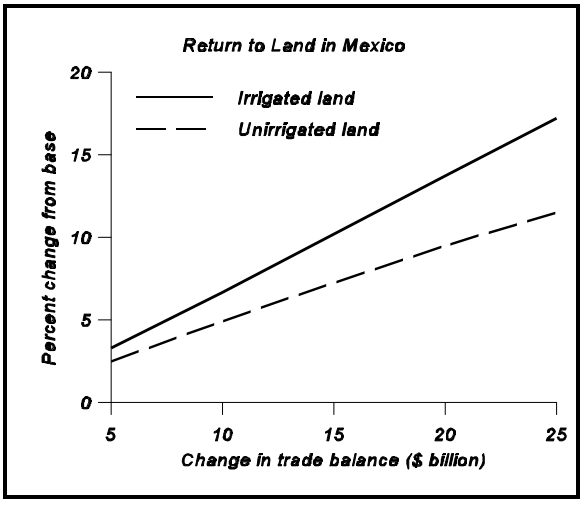

Figure 8: Returns to Land in Mexico, Medium Landing

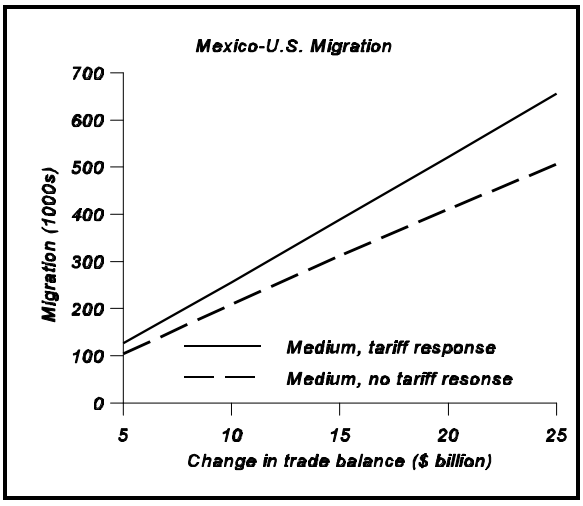

Figure 9: Mexico-U.S. Migration and U.S. Tariffs

significantly, indicating that agriculture in Mexico is tradable and benefits from depreciation. Irrigated land becomes relatively more valuable, as the expansion of fruits and vegetables, which is relatively intensive in irrigated land, draws land away from corn and bean production.

The changes in land values in Mexico under the adjustment program brings into question a major assumption underlying the PROCAMPO program. It was assumed that reform of Mexican agricultural policies, removing protection and input subsidies, would depress land values and rural incomes. The PROCAMPO program was designed to compensate farmers during a 15-year transition period for the decrease in the value of their land. However, the adjustment program now underway will increase land values, especially irrigated land. It is probably desirable to rethink the PROCAMPO program, especially given the need for Mexico to cut government expenditures. There is less need to compensate landowners, and much more need to facilitate changes in cropping patterns and marketing to take advantage of the opportunities generated by the depreciation. For example, rapid expansion of exports of fruits and vegetables requires very different marketing methods, storage facilities, and modes of transportation, compared to other crops.[10] There are important roles for government in expanding investment in rural infrastructure to support expansion of agricultural exports. The Mexican government needs to reexamine its priorities in its agricultural programs in light of the changed circumstances.

The net effect of the structural changes in agriculture is to increase the demand for labor. Corn, which is very labor intensive, does not decline much and the tradable sectors expand greatly. The large migration effects in the hard and medium landing scenarios arise from the impact of GDP declines, which affect the urban sectors the most. The increase in labor demand by the agricultural sectors generates urban-rural migration (or, in a dynamic setting, less rural-urban migration pressure) within Mexico.

Effect of U.S. Protection in Fruits and Vegetables

The depreciation of the Mexican exchange rate leads to dramatic expansion of Mexican production and exports of fruits and vegetables. The Mexicans significantly increase their share of the U.S. market. What would happen if the U.S. responded by instituting tariffs against

[10]See Josling (1992) and Cook *et al*. (1991) for a discussion of the problems and prospects facing Mexico in expanding exports of fruits and vegetables to the U.S.

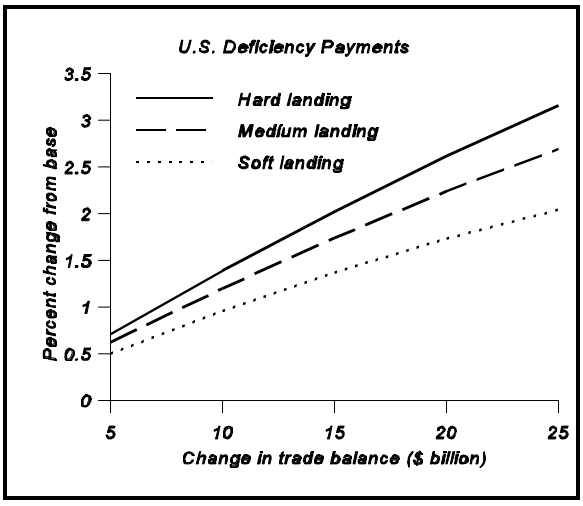

Figure 10: Change in U.S. Deficiency Payments

Mexican fruits and vegetables? To explore this question, we repeat the medium landing experiments, assuming that the U.S. raises its tariff against Mexican fruits/vegetables from zero to 25 percent, in a series of 5 percent steps that parallel the changes in the balance of trade. At the higher end, these rates are above those allowed under the "snap-back" provisions of NAFTA. This level of tariff protection essentially offsets the exchange rate depreciation and eliminates the Mexican export growth in this sector that would have otherwise occurred. In the absence of export growth to the U.S., output growth is also very small, ranging from 0.2 to 3.8 percent as the balance of trade varies.

With little growth in fruits/vegetables output, there is a significant increase in migration pressure (Figure 9). When the U.S. imposes tariffs against Mexican fruits and vegetables, migration increases by from 20 to 150 thousand, depending on the change in the balance of trade. The result is a policy dilemma for the U.S. — increased protection for domestic farmers leads to increased migration from Mexico.

U.S. Farm Program Costs

Mexican adjustment involves decreases in agricultural imports from the U.S., which are mostly program crops (Table 2). While there will be some diversion of U.S. exports to other markets, the result will be some downward pressure on U.S. prices. Given that U.S. deficiency program payments depend on the gap between market and target prices, the result will be to increase the deficiency payments. The effects are shown in Figure 10.

Assuming a $25 billion swing in Mexico's trade balance, the cost of the deficiency payment program increases from 2.0 to 3.2 percent, depending on the scenario. Assuming that the program costs about $10 billion, the increases amount to $200 to $320 million. In addition, the diversion of agricultural exports away from Mexico to other countries might well lead to increased cost of the Export Enhancement Program (EEP), as the U.S. seeks to maintain export market shares. These cost increases provide additional reasons for the U.S. to support Mexico's efforts to achieve a soft landing.

6. Conclusion

There are a number of conclusions and policy implications for both Mexico and the U.S. that arise from our empirical analysis.

- The structural adjustment process can be seen as an acceleration of beneficial trends that were occurring under NAFTA. Both the U.S. and Mexico gain from increased trade in both directions, and migration pressure is reduced.

- The danger, however, is that the economy will not be able to adjust quickly enough and that the resulting macro instability will lead to inflation and unemployment. A hard landing exacerbates migration pressure and undermines the needed structural changes.

- Successful structural adjustment lessens migration pressure, partly offsetting the direct effect of exchange rate depreciation. The net effect is that a soft landing leads to only a moderate increase in migration pressure.

- Given underlying import demand and export supply functions, the initial crisis depreciation of the Mexican peso is much more than needed to re-establish equilibrium in the sustainable balance of trade, assuming that Mexico controls inflationary pressures and panic capital flight is arrested.

- Both countries will benefit from quickly establishing a new equilibrium real exchange rate, which will minimize trade disruption and the potential impact of depreciation on migration.

- Agriculture plays a key role in Mexico's structural adjustment. Export growth in relatively high productivity sectors such as fruits and vegetables will “pull” resources, especially irrigated land, out of corn and beans. Agriculture gains from the depreciation and structural adjustment, increasing labor demand and slowing rural-urban migration. In turn, this reduces the pressures in Mexico's urban labor markets and reduces migration pressure to the U.S.

- Mexican adjustment has agricultural policy implications for both countries. For Mexico, the acceleration of structural changes and efficiency gains in agriculture increase land values and alleviate the need for transitional payments to landowners under PROCAMPO. Structural adjustment should provide Mexico the flexibility to reevaluate its agricultural policy, enabling a shift from income support to rural investment that will support the needed structural changes and facilitate increased exports.

- For the U.S., maintaining open import markets is important to support Mexican adjustment. This is particularly true for fruits and vegetables, but also relevant for manufacturing. The policy dilemma for the U.S. is that any attempt to increase protection for U.S. farmers in response to increased Mexican exports will significantly increase migration pressure.

The Mexican and U.S. economies have become increasingly integrated, in factor markets as well as product markets. NAFTA can be seen as validating past trends and encouraging closer integration in the future, as well as committing Mexico to continue the reform process it started in the mid-1980s. It is clearly in the interests of both countries to manage the response to the crisis so as to achieve a soft landing for Mexico and a resumption of Mexican growth. The existence of NAFTA should facilitate this process, and it is not in the interests of either country to slow or reverse the integration process under NAFTA.

References

Burfisher, Mary, Sherman Robinson, and Karen Thierfelder (1994). "NAFTA, Mexican Agricultural Policy Reform, and Labor Mobility." In Thomas Grennes and Gary Williams, eds., NAFTA and Agriculture: Will the Experiment Work? Minneapolis, MN: International Agricultural Trade Research Consortium.

Burfisher, Mary, Sherman Robinson, and Karen Thierfelder (1992). "Agriculture and Food Policies in a U.S.-Mexico Free Trade Area." North American Review of Economics and Finance, Vol. 3, No. 2, pp. 117-139.

Burfisher, Mary, Karen Thierfelder, and Kenneth Hanson. "Data Base for a Computable General Equilibrium Model of the United States and Mexico." Washington D.C.: Staff Report No. AGES9225. U.S. Department of Agriculture, Economic Research Service.

Congressional Budget Office (1993). A Budgetary and Economic Analysis of the North American Free Trade Agreement. Washington, D.C.: Congressional Budget Office, U.S. Congress, July.

Cook, Roberta (1991). Chapters in American Farm Bureau Research Foundation, Volume 4: Implications of the NAFTA for the U.S. Fruit and Vegetable Industry. Park Ridge, IL: American Farm Bureau.

Hinojosa, Raúl-Ojeda and Sherman Robinson (1992). "Labor Issues in a North American Free Trade Area." In N. Lustig, B.P. Bosworth, and R.Z. Lawrence, eds., North American Free Trade: Assessing the Impact. Washington, D.C.: The Brookings Institution.

Josling, Tim (1992). "NAFTA and Agriculture: A Review of the Economic Impacts." In N. Lustig, B.P. Bosworth, and R.Z. Lawrence, eds., North American Free Trade: Assessing the Impact. Washington, D.C.: The Brookings Institution.

Lozano Ascensio, Fernando (1993). "Bringing it Back Home: Remittances to Mexico from Migrant Workers in the U.S." Monograph Series No. 37, Center for U.S.-Mexican Studies, University of California, San Diego.

Sachs, Jeffrey, Aaron Tornell, and Andres Velasco (1995). "The Collapse of the Mexican Peso: What Have We Learned?" Harvard Institute of Economic Research, Discussion Paper 1724.